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Social Isolation, Social and Emotional Loneliness, and Self-Reported Hearing Difficulties in Older Adults with Hearing Loss

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SOCIAL ISOLATION, SOCIAL AND EMOTIONAL LONELINESS, AND SELF-REPORTED
HEARING DIFFICULTIES IN OLDER ADULTS WITH HEARING LOSS

by

YULIYA BORIK

A capstone research project submitted to the Graduate Faculty in Audiology in partial fulfillment of the requirements for the degree of Doctor of Audiology, The City University of New York

2016

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This manuscript has been read and accepted for the
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ABSTRACT

SOCIAL ISOLATION, SOCIAL AND EMOTIONAL LONELINESS, AND SELF-REPORTED HEARING DIFFICULTIES IN OLDER ADULTS WITH HEARING LOSS

by

Yuliya Borik

Adviser: Professor Barbara Weinstein

Hearing loss is known to affect communicative ability and has been associated with poor health-related outcomes such as impaired cognition, increased risk for falls, and psychotic manifestations. Social isolation and loneliness are also widely recognized to negatively impact mental and physical health. The purpose of this systematic review is to review literature that explores a relationship between hearing loss with and/or without self-reported hearing difficulties and social isolation and social and emotional loneliness in older adults with hearing loss ranging from mild to profound. The goal is to determine whether there is a direct relationship between subjective and/or objective hearing loss and subjective and/or objective social isolation and whether social isolation and/or social and emotional loneliness plays a mediating role in poor health-related outcomes that have been associated with hearing loss.

The systematic review of the literature on this topic focused on studies that satisfied specific design criteria. Only studies that assessed the relationship between hearing status and social isolation and/or loneliness among participants aged 50 years or older with perceived or measured hearing loss ranging from mild to profound met the inclusion criteria for this review. Database searches of refereed, peer-reviewed journals were conducted. Relevant search strings

applied to the Cumulative Index to Nursing and Allied-Health Literature (CINAHL), Academic Search Premier, PubMed, Google Scholar, MEDLINE, and psycINFO databases identified studies to be included in this review. Additionally, manual searches of the references of applicable articles were also conducted. Nineteen studies met a priori criteria for inclusion in this review.

A thorough qualitative assessment of the research showed that there is a strong association between hearing loss and self-perceived hearing difficulties with social isolation and loneliness in the older adult. This review concludes that there is an agreement among researchers that hearing status is associated with social isolation and loneliness. However, inconsistencies in reporting on an age and gender effect of individuals with reduced hearing abilities on social isolation and/or loneliness is observed. This observation points to a need for investigations that employ more controlled studies in order to confirm a causal effect of hearing status on social isolation and/or loneliness and how variables of age, gender, and intervention strategies mediate the above-mentioned psychosocial outcomes.

Key Words:

Self-reported hearing difficulties, hearing loss, older adults, social isolation, loneliness, de Jong Gierveld Loneliness Scale, UCLA Loneliness Questionnaire, HHIE

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ABBREVIATIONS

ADL = activities of daily living

AI = Amsterdam Inventory

CARE = Comprehensive Assessment and Referral Evaluation

CI = cochlear implant

DG Loneliness Scale = De Jong Gierveld Loneliness Scale

GDS = Geriatric Depression Scale

HA = hearing aid

HHIE/A (-S) = Hearing Handicap Inventory for Elderly/Adults (-Summarized version)

HI = hearing impairment

HL = hearing loss

HMS = Hearing Measurement Scale

HRQOL = Health-related quality of life

IADL = independent activities of daily living

MDS 2.0 = Minimum Data Set 2.0 questionnaire

MMSE = Mini Mental State Exam

NHANES SSQ = National Health and Nutrition Examination Survey Social Support
Questionnaire

OI = objective isolation

PTA = pure tone average

QoL = quality of life

SELF = Self-Evaluation of Life Function

SF-36; SF-12 = Medical Outcomes Study 36 Short-Form; 12 Short-Form (shortened version)

SI = subjective isolation

SIN = speech-in-noise

SIS = social isolation score

SNHL = sensorineural hearing loss

UCLA Loneliness Scale = University of California, Los Angeles Loneliness Scale

INTRODUCTION

In the United States and around the world, the number of older adults, or people over the age of 60 years (World Health Organization [WHO], 2016), continues to grow at an unprecedented rate. In the world, the number of people aged 60 years or over is projected to grow by 56%, from 901 million in 2015 to 1.4 billion in 2030. By 2050, that number is projected to double in size to nearly 2.1 billion (United Nations, Department of Economic and Social Affairs, Population Division, 2015; WHO, 2015). Americans aged 65 years or older will consist of approximately 89 million people by 2015, a number that will have more than doubled than that of older adults in 2010. According to Holtzman & Anderson (2012), the last baby boomer will have turned 65 years of age in the year 2030 at which time approximately 72 million people (about one of every five Americans) will be an older adult (Centers for Disease Control and Prevention, Merck Institute of Aging & Health. State of Aging and Health in America Report, 2013.). The “oldest-old” population, or people aged 80 years or over, is growing at an even faster rate than the number of older persons overall. In 2050 it is projected that the oldest-old population will more than triple from 125 million in 2015 to 434 million in 2050 (United Nations Population Division, 2015). “The proportion of very old adults in industrialized countries continues to grow at a phenomenal rate” (Dugan & Kivett, 1994).

With respect to the aging population by gender, women have been found to outlive men between the years 2010 and 2015 by an average of 4.5 years. In 2015, women accounted for 54 per cent and 61 per cent of those aged 60 and 80 years or over, respectively. By 2050, however, the proportion of women aged 80 years or over is projected to decline to 58 per cent in 2050 as

the average survival of males is projected to improve and catch up to that of females (United Nations Population Division, 2015).

The increase in life-expectancy, however, does not equate to an improvement in health conditions (WHO, 2014). In America, the trend toward a greater proportion of older adults will have wide-ranging implications for nearly every facet of American society. People over the age of 60 years carry approximately a quarter of the overall global burden of death and illness. Much of the burden is attributed to long-term illness caused by diseases such as cancer, chronic respiratory diseases, heart disease, musculoskeletal diseases, and mental and neurological disorders. These conditions diminish the overall well-being of this population of adults, their families, health systems, and economies (Centers for Disease Control and Prevention, Merck Institute of Aging & Health, 2013).

According to WHO (2016), over 20% of adults aged 60 years or over suffer from a mental or neurological disorder. The most common neuropsychiatric disorder in this age group are dementia and depression. WHO (2016) reports on higher rates of depression among older adults with a physical condition (i.e., heart disease) and that outcomes of a physical disease are negatively affected by untreated mental disorder (i.e., depression), suggesting that mental health has an impact on physical health and vice versa. Of importance, Uhlman, Larson, Reese, Koepsell and Duckert (1989) caution that when working with this population, one must be careful to differentiate between symptoms of dementia and those of a communication disorder as a communication disorder may make older individuals appear more cognitively impaired than they are (as cited in Brink & Stone, 2007).

Healthy Aging:

Weinstein (2013), defines aging as “a global, complex, synchronized biological process that occurs across all species at a rate that varies considerably.” Genetics plays an important part in the regulation of biological aging, however, environmental factors (extrinsic) may play a bigger role than genetic (intrinsic) factors. According to Weinstein (2013), aging can be summarized as being driven by a lifelong accumulation of random cellular damage. The cellular defects and slower cellular repair systems lead to age-associated frailty, disability, and disease. The progression of these effects can be moderated by environmental factors such as diet, exercise, and social interaction.

There are multiple theories on aging, though none can stand alone. The Baltes model of aging, for example, focuses on how individuals can cope with age-related losses (as cited in Kahn, 2004). The current viewpoint on aging, however, focuses on “healthy aging” which is in better alignment with a theory proposed by Rowe and Kahn (1998). Funded by the MacArthur Foundation, researchers Rowe and Kahn studied 1000 older adults over 7 years and published their findings in 1998. According Row and Kahn (1998), aging in itself is not a pathologic state and there exists a distinction between older people with disabilities and older people with better-than-usual aging. As per the Rowe-Kahn model, this “better-than-usual” group of older people are categorized as successful agers who are (1) minimizing the risk of disease and disability, (2) maintaining physical and mental function, and (3), continuing engagement with life. The last component of continuing engagement with life includes having close social relationships, involvement in activities that are meaningful and productive, and using valued skills and abilities. Successful aging depends on having a combination of all three components. Unlike the Baltes model of aging, the Rowe-Kahn model encourages a more active approach to healthy

aging by imparting the responsibility on the individual and society to seek out opportunities that encourage vitality, activity, and productivity in old age.

Furthermore, and aligned with Weinstein's description of successful aging as moving away from preoccupation of disease to health promotion, Rowe and Kahn believe that "usual aging" is modifiable. Environmental and behavioral factors are important determinants regarding health risk. Education is a predictor of future cognitive function. Amount of strenuous physical activity in the home was a predictor of maintenance of cognitive function. Self-efficacy was correlated with maintenance of cognitive function; self-efficacy was positively related to productivity. Maintenance of physical function was predicted by moderate and/or strenuous physical leisure activity and emotional support from family and friends. A component of successful aging is continuing engagement with life; productive activities (informal help-giving, paid and volunteer work), and social relations (social ties to friends, family and community) (Rowe & Kahn, 1998).

Hearing Loss and Aging:

In older adults, hearing loss is the third most common chronic health condition. Approximately one-third of people over 65 years of age are affected by disabling hearing loss (WHO, 2015). The majority of older people have age-related hearing loss (ARHL), or presbycusis, which is commonly a symmetrical sensorineural hearing loss that occurs with aging (Pronk et al., 2014). Age-related hearing loss (ARHL) is a highly prevalent condition in older adults (Kramer, Kapten, Kuik, & Deeg, 2002). "According to the International Classification of Functioning, Disability and Health of WHO, disability encompasses impairments, activity

limitations, and participation restrictions (WHO, 2001). The impact of HI cannot be predicted by audiometric results alone as personal and environmental factors have a significant influence on the extent of hearing-related activity limitations and participation restrictions (Wiley, Cruickshanks, Nondahl, & Tweed, 2000). Activities limited by HI include the following:

- Speech perception, especially in adverse environments with noise, reverberation, high speech rate, accented speech, and/or when the face of the person talking cannot be seen;
- Understanding of broadcast signals such as radio and television;
- Localization of sound sources such as footsteps and cars; and
- Detection of environmental signals including ringing telephones, doorbells, and alarms.

Participation restrictions caused by hearing impairment include the following:

- Withdrawal from previous involvement in community life; and
- Avoidance of interpersonal interactions (as cited in Laplante-Lévesque, Hickson, & Worrall, 2010)”

A common misconception, hearing loss is actually not part of healthy aging.

Relationship between Hearing Loss and Psychosocial and Health Outcomes:

Beyond activity limitations and participation restrictions, consequences of hearing impairment extend to areas of well-being. Chia et al. (2007) have found that bilateral age-related hearing impairment is associated with poorer HRQoL in both physical and mental domains (as

cited in Laplante-Lévesque, Hickson, & Worrall, 2010). HRQoL is defined as “individuals’ perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns” (WHO-QOL Group, 1995, p1405). Similarly, Hogan, O’Loughlin, Miller, and Kendig (2009) found that hearing disability at all levels is associated with poorer physical and mental health scores as measured by the SF-12, with a stronger association found among those with severe or profound hearing loss.

Previous studies have shown that poor hearing is associated with poor psychosocial and health outcomes. Recently, Li et al. (2013), Lin et al. (2011), Lin, Thorpe, Gordon-Salant, and Ferruci (2011), and Lin et al. (2013) have shown that poor hearing is associated with a poor psychosocial outcome of depression (as cited in Sung et al., 2015). Genter, Frick, Chen, Betz, & Lin (2013) and Lin and Ferrucci (2012), in their prospective aging studies, have found that hearing loss is an independent risk factor for poor general health and falls, respectively.

Hearing impairment has been associated with cognitive status. Cacchione, Culp, Laing, & Tripp-Reimer (2003) found that hearing impairment is a risk factor for acute confusion and Naramura et al. (1999) and Raiha et al. (2001) found that hearing impairment is associated with poorer performance on mental status tests (as cited in Brink & Stone, 2007). In one prospective aging study, Lin, Ferrucci, Metter, An, Zonderman, and Resnick (2011), found that hearing loss is an independent risk factor for dementia. Similarly, Gallacher et al. (2012) reported on incident dementia in their longitudinal cognitive study using pure-tone audiometry to assess hearing. Uhlman et al. (1989) and Lin et al. (2013) found an association between hearing loss and cognitive decline. Other cross-sectional and longitudinal imaging studies using pure tone audiometry to assess hearing have found differences in brain volume in auditory cortices (Peele et al., 2010) and decline in whole brain and regional volumes (Lin et al., 2014).

In a meta-analysis conducted by Linzen, Brouer, Heringa, and Sommer (2016), an increased link of hearing impairment has been found on all psychosis outcomes, namely hallucinations, delusions, psychotic symptoms, and delirium. The authors state that the risk of developing schizophrenia is increased the earlier an individual is exposed to hearing impairment.

Early intervention findings by Weinstein and Amsel (1986) showed that scores on the mental status scores increased when seniors with hearing impairment wore hearing aids, suggesting that “although level of hearing can have acute effects on cognitive status, issues about causality remain unresolved” (as cited in Brink & Stone, 2007). More recently in a prospective population-based study, Amieva, Ouvrard, Guilioli, Meillon, Rullier, and Dartigues (2015) found in their 25-year study that self-reported hearing loss is associated with accelerated cognitive decline in older adults and that hearing aids attenuates this decline. The evidence suggests that hearing loss does not have a direct effect on cognitive decline but “rather that depressive symptoms and social isolation mediate the association.” They suggest that “by partially restoring communication abilities, hearing aids may help improve mood, increase social interactions, and enable participation in cognitively stimulating abilities and consequently could slow cognitive decline.”

Interpersonal relationships are seriously affected by hearing impairment as hearing impairment impedes on a person’s ability to communicate with others (Slawinski, Hartel, & Kline, 1993; as cited in Strawbridge, Wallhagen, Shema, & Kaplan, 2000). Others have echoed this this statement:

“Because hearing loss is a kind of sensory deprivation, it tends to decrease verbal communication, an important source of human intimacy. Therefore, hearing loss may

lead to loneliness; however, studies exploring the relation between hearing loss and loneliness have not yet produced conclusive results” (Chen, 1994).

“Age-related hearing loss (ARHL) ... directly impairs communicative functioning and could plausibly contribute to loneliness in older adults (Sung, Li, Blake, Betz, & Lin, 2015).”

Social Isolation, Loneliness, and distinction between Social and Emotional loneliness:

According to Nicholson (2009, p. 1346), social isolation is defined as “a state in which the individual lacks a sense of belonging socially, lacks engagement with others, has a minimal number of social contacts and they are deficient in fulfilling and quality relationships (as cited in Nicholson, 2012). D. W. Russel (1996) defines social isolation as an objective measure—the frequency or number of social contacts (as cited in Sung et al., 2015). An example of measure used to quantify social isolation is the Social Isolation Scale (Greenfield, Rehm, & Rogers, 2002) or the Social Network Index (bottom quartile; Berkman & Syme, 1979) (as cited in Holt-Lunstad, J., Smith, T. B., Baker, Harris, T., & Stephenson, D., 2015).

Two dimensions of social isolation have been introduced by Weiss (1973) based on an interactionist perspective. The one dimension is “social isolation” which “results from being or feeling detached from a social network or community. It “stems from a disruption in linkages to a supportive network and may prompt feelings of vulnerability, marginality, tension, and boredom. The second is called “emotional isolation” which he describes as “resulting from the loss of an attachment figure.” Per Weiss’s 1989 definition, an attachment figure is “one that is security-providing because of a perceptual and emotional sense of linkage to that figure. Various

responses are associated with emotional isolation, including yearning for the lost attachment figure, distress, and depression. The relationship with a spouse, child, or confidant may be emotionally close, and thus function as a security-providing attachment” (as cited in Dugan & Kivett, 1994).

Loneliness is “a subjective phenomenon and is generally rooted in self-perceived inadequacies in interpersonal relationships” (D. W. Russel, 1996; as cited in Sung et al., 2015). According to Hawkey and Cacioppo (2003), loneliness is the discrepancy between actual and desired social contact (as cited in van der Werf et al., 2010). It is the perception of social isolation, or the subjective experience of being lonely. De Jong Gierveld (1987, p. 120) defined it as ‘a situation experienced by the individual as one where there is an unpleasant or inadmissible lack of (quality of) certain relationships’ (as cited in Świtaj, Grygiel, Anczewksa, & Wciórka, 2014). Similar to social isolation, loneliness can also be subcategorized as “social loneliness, defined as the absence of a broader engaging social network (e.g., siblings, cousins, friends, and neighbors), and emotional loneliness, which refers to the absence of an intimate relationship (e.g., partner, best friend) (De Jong Gierveld & Kamphuis, 1985; as cited in Weinstein, Sirow, & Moser, 2016).

Loneliness can be quantified using the Jong-Gierveld Loneliness Questionnaire (De Jong Gierveld & Kamphuis, 1985). The DG Loneliness Scale includes two subscales in accordance with the cognitive theoretical approach to loneliness which measures both emotional and social loneliness (De Jong Gierveld & Kamphuis, 1985). The social loneliness subscale consists of five positively worded items (e.g., “There are plenty of people that I can lean on in case of trouble”), whereas the emotional loneliness subscale comprises six negatively worded items (e.g., “I experience a general sense of emptiness”). Total scale scores range from 0 (*not lonely*) to 11

(*extremely lonely*). A total score of two or less is considered a pass (respondent is free of feelings of loneliness). A total score of three or greater is consistent with moderate or severe levels of loneliness (Sansoni, Marosszeky, Sansoni, & Fleming, 2010; Van Tilburg & De Jong Gierveld, 1999). Hence, scores on the loneliness scales are integral numbers (e.g., 2 or 3 rather than 2.1, 2.5). Internal consistency reliability ($\alpha = .84$) is considered acceptable on the basis of Cronbach's alpha levels from a number of studies (De Jong Gierveld & Van Tilburg, 1999)" (as cited in Weinstein, Sirow, & Moser, 2016).

Loneliness has also been quantified using the University of California, Los Angeles Loneliness Scale (Russel, 1987). This is a relatively short, 20-item scale that assesses an individual's satisfaction with social relations. This self-assessment inventory has been found to be highly reliable and valid in both assessing loneliness as a unidimensional phenomenon, and in discriminating between loneliness and other constructs (as cited in Christian, 1989).

While it has been found by Yildirim & Kocabiyyik (2010) that people lacking human contact often feel lonely, Coyle and Dugan (2012) suggested that there is often no significant correlation between social isolation and loneliness, stating that the two may be independent constructs in which one may occur without the other (as cited in Holt-Lunstad, Smith, & Layton, 2015). Peplau and Perlman (1982), however, report that feelings of loneliness may be promoted by social isolation (as cited in Hawkley, Thisted, & Cacioppo, 2009).

Social Isolation and Loneliness in Older Adults:

According to Mullins and Dugan (1990), "older adults are more likely to have lost relationships due to retirement, relocation, and death, and are at greater risk of becoming socially isolated with advancing age than younger adults (as cited in Dugan & Kivett, 1994). Berguno,

Leuroux, McAinsh, and Shaikh (2004), Pinquart and Sorensen (2001), and Weeks (1994) have found that as many as 40% of adults over the age 65 years have reported being lonely at least sometimes, with Pinquart and Sörensen reporting that levels of loneliness gradually diminish through the middle adult years and then increase in old age (i.e., ≥ 70 years) (as cited in Hawkey & Cacioppo, 2010).

A meta-analysis by Pinquart and Sörensen (2001) revealed that it is the quality of social network that is more strongly correlated with loneliness than quantity of social network. Being a woman, having low socio-economic status and low competence, and living in nursing homes were also associated with higher loneliness.

It is important to remember, however, that like hearing loss, depression and social isolation are not normal for older Americans and that the norm for today's older adults is living happily and productively (APA, 2016).

Relationship between Social Isolation and Loneliness and Health Outcomes:

It is widely recognized that social relationships and affiliation have powerful effects on physical and mental health (Berkman, Glass, Brissette & Seeman, 2000). Abundant literature demonstrates that loneliness is strongly associated with cognitive impairment and poor mental health (Wilson et al., 2007), depressive symptoms (Cacioppo, Hawkey, & Thisted, 2010), and increased systolic blood pressure (Hawkey, Thisted, Masi, & Cacioppo, 2010). Social isolation and loneliness have been associated with reduced physical activity levels (Hawkey, Thisted, & Cacioppo, 2009) and were identified as risk factors for physical and mental health problems, including cardiovascular disease and heightened inflammatory response to stress (Cacioppo et

al., 2000; Hawkley & Cacioppo, 2010; Steptoe, Owen, Kunz-Ebrecht, & Brydon, 2004; as cited in Sung et al., 2015).

Holmes (1956) and Tillman and Hobbs (1949) found that unmarried and more socially isolated people have manifested higher rates of tuberculosis and accidents, respectively. Faris (1934) and Kohn and Clausen (1955) found that there is a higher rate of psychiatric disorders such as schizophrenia in the unmarried and more socially isolated people (as cited in House, Landis, & Umberson, 1988).

O’Launaigh, O’Connell, Chin, Hamilton, Coen, Walsh, Walsh, Caokley, Cunningham, and Lawlor (2012) found that loneliness was significantly associated with impaired global cognition independent of social networks and depression. Specifically, domains of psychomotor processing speed and delayed visual memory were associated with self-reported loneliness (O’Launaigh et al., 2012).

Cacioppo et al. (2002), Hawkley et al. (2009), and Theeke (2010) have found that both loneliness and social isolation are associated with poorer health behaviors such as smoking, physical inactivity, and poorer sleep.

Switaj et al. (2014) found that loneliness is the mediating factor between the relationship of internalized stigma and depression among patients with psychotic disorders. According to Dugan & Kivette (1994), “higher levels of social withdrawal attributed to hearing impairment are reflected by increased loneliness and social isolation and likely to contribute to depressive symptoms” (as cited in Brink & Stones, 2007).

Objectives and Research Questions

Evidence points to a mediating role of loneliness and/or social isolation to adverse health outcomes. With an aging population on the rise, it is important to determine if hearing impairment contributes to social isolation or feelings of loneliness experienced by older adults. The purpose of this review is to systematically analyze the existing literature investigating the effects of hearing loss on social isolation and feelings of loneliness in the older adult. It is hypothesized that a hearing impairment is associated with increased risk of objective and subjective social isolation and that intervention (i.e., in the form of hearing aids or cochlear implants) would counteract this negative effect. The goal of this systematic review is to bring awareness to readers about the importance of identifying older adults who can benefit from hearing care. In addition, the following questions are considered:

- 1) (Dose Effect) Is there a relationship between the degree of hearing loss and subjective or objective social isolation?
- 2) (Age Effect) Is there an age effect in the relationship between self-reported hearing loss and social isolation and loneliness?
- 3) (Gender Effect) Is there a difference between men and women's perception of social isolation and loneliness and does this influence health effects differently?
- 4) (Intervention) What are the protective properties of amplification and/or cochlear implants on social isolation and/or loneliness (if any?)

METHODS

For purposes of this review, a search was performed in the PubMed, MEDLINE, psycINFO, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Academic Onefile, and google scholar databases to identify studies investigating the relationship between subjective and/or objective hearing loss and social isolation and/or social and emotional loneliness. Articles matching the terms *elderly*, *older adult*, *psychosocial*, *hearing impairment*, *hearing loss*, *self-reported hearing handicap*, *hear**, *self-rated health*, *psych**, *social isolation*, *social**, *emotion**, *loneliness*, and *lone**, published between 1890 and March 2016 that were written in English were examined. Additionally, reference lists of each identified article were manually searched to target additional, relevant articles not found in the database search.

Inclusion of published studies in this systematic review was guided by PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses), formerly QUOROM (Quality Of Reporting Of Meta-Analysis), as described by Moher, Shamseer, Clarke, Ghersi, Liberati, Petticrew, Shekelle, Stewart, and PRISMA-P Group (2015). The PRISMA Statement aims to help researchers improve the reporting of systematic reviews and meta-analysis and consists of a 17-item checklist (25 including sub-items). The selection criteria for inclusion in this systematic review consisted of older adults with hearing loss ranging from mild to profound. Only studies specifically describing an outcome variable of loneliness, emotional and/or social loneliness, social network, and social isolation that also utilized standardized self-assessment measures were included in the qualitative analysis. Literature reviews, editorial comments, and expert opinions were excluded from this review. It is acknowledged that a publication bias may exist by only searching databases with published studies, and only studies in English.

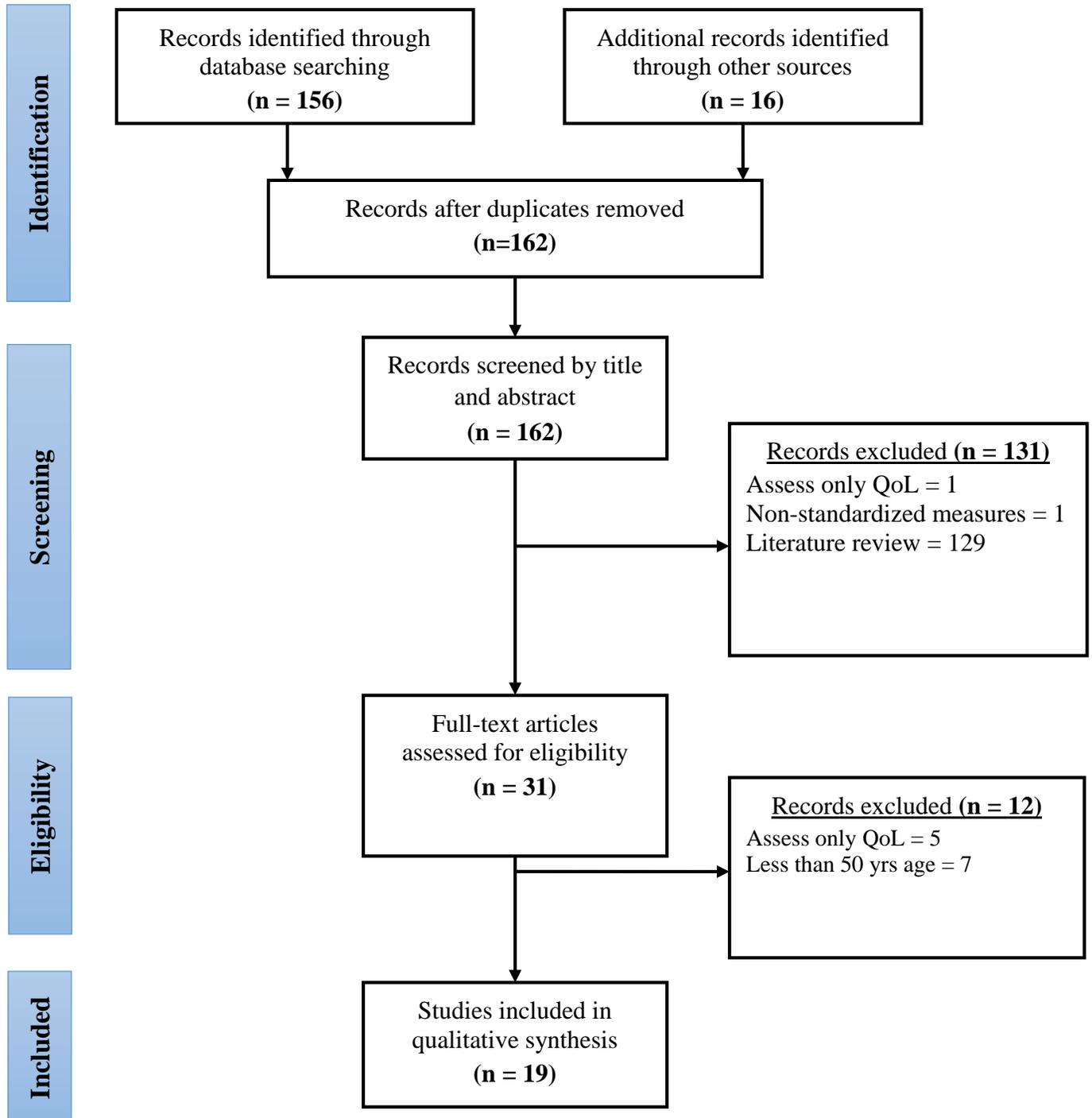


Figure 1. PRISMA Flow Diagram of the performed literature search, as performed on March 26, 2016

RESULTS

Study Flow

One hundred and fifty six articles were identified for title and abstract review utilizing combinations of selected keywords in the library databases, as previously described. Sixteen additional articles were identified through manual search of reference lists. Following removal of duplicates, one hundred and fifty six articles were screened using title and abstract review, of which one hundred and thirty one were excluded as they did not involve human subjects, found to not have an outcome variable of social isolation and/or loneliness, or used non-standardized measures. Full-text review of the remaining thirty one articles revealed five more articles which did not include an outcome of loneliness or social functioning, and seven articles that included participants less than 50 years of age, thus reducing the final list to nineteen published articles. The search and retrieval process is illustrated in Figure 1 (**See Figure 1**).

Description of Studies

A majority of studies identified involved cross-sectional studies with which there exists a limitation of the inability to make inferences about an existence of a causal relationship between variables in the study. Two longitudinal studies were found that investigated the effects of hearing on loneliness in population-based samples (Strawbridge et al., 2000; Wallhagen et al., 1996) but both was excluded from this qualitative analysis as they did not use a standardized assessment to measure loneliness. Four of the nineteen studies were interventional and assessed an impact of amplification (Chia et al., 2007; Tesch-Römer, 1997; Weinstein et al., 2016) or cochlear implantation (Poissant et al., 2008) on social isolation and/or loneliness. Poissant et al.

(2008) also included age-matched bilateral hearing aid users with hearing loss in the mild to moderate levels of degree for comparison to the two other groups consisting of unilateral CI recipients greater than or equal to age 70 years and of unilateral CI recipients less than or equal to age 60 years. Chia et al. (2007) was the only study identified that had social isolation, rather than loneliness, as their dependent variable.

A summary of the studies chosen for inclusion in this review is illustrated in Tables 1a, b, and c (**See Table 1a, b, and c**). The summary provides a description of study design, number and age of participants, as well as additional relevant characteristics, a description of the outcome measures, and summarized results. Additionally, Table 2 provides a summary regarding the self-assessment measures utilized by each included study with a description of what each assessment measures (**See Table 2**).

Design Methodology

Study Characteristics:

Age

All studies included participants over 50 years of age, considered to be older adults as per Sung et al. (2015). Only three studies included in this review analyzed data of participants beginning at 50 years of age (Sung et al., 2015) and at 55 years of age (Kramer et al., 2002). Additionally, Poissant et al. (2008) stratified their sample into a group of participants aged 70 years or older and another aged 60 years or younger. Mick et al. (2014) was the only other study identified that also stratified their sample into two age groups, but the youngest participant in this study was aged 60 years.

Gender

All studies included participants of both male and female gender.

Degree of Hearing Loss

Degree of hearing loss ranged from mild to profound. Seven of the nineteen studies did not measure objective hearing loss as they required participants to report only their self-perceived hearing difficulties.

Outcome Measures:

Out of a total of eight studies with an objective to determine a relationship between hearing status and social isolation, three used the SF-36 scale (Sung et al., 2015; Chia et al., 2007; Appolonio et al., 1996), another used subscales of the Tokyo Metropolitan Institute of Gerontology Index of Competence (TMIG-IC) (Yamada et al. 2012), a fifth used 3-item SIS measure from the NHANES SSQ and marital status assessment (Mick et al., 2014), a sixth used the 4-item SIS measure from the NHANES SSQ (Mick & Pichora-Fuller, 2016), the seventh used the SELF scale (Mulrow et al., 1990), and the remaining two used the MDS 2.0 questionnaire (Brink & Stones, 2007; Resnick et al., 1997).

Out of the nine studies aimed at determining the relationship between hearing status and loneliness, four used the UCLA Loneliness Scale (Christian et al., 1989; Chen, 1994; Poissant et al., 2008; and Sung et al., 2015), one used the SI and OI scale from the CARE assessment tool (Weinstein & Ventry, 1982), and four used the DG Loneliness Scale (Pronk et al., 2011; 2013; 2014; Weinstein et al., 2016).

Of the two studies that examined the relationship between hearing loss and both social isolation and loneliness, one used the UCLA Loneliness Scale (Tesch-Römer, 1997) and one used the DG Loneliness Scale (Kramer et al., 2002).

Hearing Status and Social Isolation and Loneliness:

Kramer et al. (2002) found that hearing impaired elderly reported significantly more feelings of loneliness as well as a smaller social network than normally hearing peers. Their findings demonstrated that unlike chronic diseases that show significant associations with *some* outcomes, hearing impairment shows significant associations with *all* psychosocial outcomes.

Hearing Status and Social Isolation:

According to Chia et al. (2007), hearing loss is implicated in the development of social isolation. Using the SF-36 Scale, they found that hearing impairment was associated with poorer scores in the functioning and role limitation due to emotional problems. Brink and Stones (2007) also found an association between HI and social isolation (measured as social engagement) via the mediator of mood. Yamada et al. (2012) found that self-reported hearing loss was associated with a decline in IADL, but not with social participation. Mick et al. (2014) found that there is a strong association between hearing loss and social isolation but only in the 60- to 69-year old women, and not in men or in older individuals.

Hearing Status and Loneliness:

“Weinstein and Ventry (1982) were one of the first researchers to alert clinicians of the psychosocial consequences and effect on communication of presbycusis. They implicated a relationship between hearing impairment and social isolation among community-dwelling elderly individuals. Using a number of tests (i.e., pure-tone testing, speech discrimination testing, and self-assessed hearing handicap), Weinstein and Ventry reported that, specifically, measures of subjective isolation (loneliness) rather than objective isolation (social isolation) are strongly associated with hearing handicap” (as cited in Brink & Stones, 2007). In their study, an

observation was made that the HMS score was significantly correlated with each isolation measure. This finding implicated the importance of incorporating self-assessment scales in the evaluation of hearing-impaired elderly.

In Christian et al.'s (1989) quest to determine the distribution and relationship of hearing loss and loneliness in the elderly, they found that loneliness scores, as measured by the UCLA Loneliness Scale, increase as the elderly develop greater hearing impairment.

In line with the aforementioned studies, Cheng (1994) also found a significant correlation of hearing handicap with loneliness (in addition to self-esteem).

A summary of articles identified that investigated the dose, age, gender, and intervention effects on social isolation and/or loneliness is outlined in Table 3 (**See Table 3**).

Research Question 1: (Dose Effect) Is there a relationship between the degree of hearing loss and subjective or objective social isolation?

Hearing Status and Social Isolation:

No dose effect was measured or found in five of six studies included in this review (Brink & Stones, 2007; Chia et al., 2007; Yamada et al., 2012; Mick et al., 2014; Mick & Pichora-Fuller, 2016). A dose effect was found by Resnick and colleagues (1997) who found a stronger association between severe hearing impairment and social engagement than between a moderate hearing loss and social engagement.

Hearing Status and Loneliness:

Five out of thirteen studies demonstrated a dose effect in that a greater degree of hearing loss or perceived hearing difficulty was found to strongly correlate with a greater degree of loneliness (Weinstein & Ventry, 1982; Christian et al., 1989; Chen, 1994; Pronk et al., 2013; and Weinstein, Sirow, & Moser, 2016). Moreover, Pronk et al. (2014) determined that the faster the rate of hearing decline, the greater the increase in loneliness there will be in specific subgroups of older persons. Specifically, it was found that a faster decrease in hearing status, as measured by SIN tests, was significantly associated with a greater increase in loneliness for individuals with a moderate baseline SIN recognition (social and emotional loneliness) and for those who recently lost their partner (emotional loneliness). Cheng (1994) also implied from his findings that the higher the elder's level of hearing handicap, the greater the loneliness experienced, and that, in effect, the higher the loneliness level, the lower the self-esteem.

Research Question 2: (Age Effect) Is there an age effect in the relationship between self-reported hearing loss and social isolation and loneliness?

Hearing Status and Social Isolation:

Two of the five studies assessing the relationship between hearing status and social isolation found an effect of age on social isolation assessments (Mick et al., 2014; and Mick & Pichora-Fuller, 2016). Mick et al. (2014) found that greater hearing loss was associated with increased odds of social isolation in women aged 60 to 69 years but not in women aged 70 to 84 years. Mick & Pichora-Fuller (2016) found that unacknowledged or unaddressed hearing loss was associated with a significantly increased risk of social isolation among 60 to 69 year olds but not among those 70 years or older.

Hearing Status and Loneliness:

Christian et al. (1989) and Sung et al. (2015) found that greater loneliness was associated significantly more with younger age and greater hearing loss. The literature generally supports the idea that loneliness does not necessarily increase with age, although there is some evidence that there is a sharp increase in loneliness after the age of 80 (Russel, 1982; as cited in Christian et al., 1989). Conversely, Chen (1994) found in their sample that a greater percentage of participants experienced loneliness in the upper third were those in the 75 to 94 age group than those in the 65 to 74 year group.

Research Question 3: (Gender Effect) Is there a difference between men and women's perception of social isolation and loneliness and does this influence health effects differently?

Hearing Status and Social Isolation:

Mick et al. (2014) found that greater hearing loss was associated with increased odds of social isolation in women aged 60 to 69 years but not in men. According to Mick et al. (2014), the odds of social isolation increased 3.49 times with every 25-dB shift in PTA (95% confidence interval [CI]: 1.91-6.39, $P < .001$) in women. The association in men, however, was not significant (OR 1.11, 95% CI: 0.66-1.81, $P=.68$) (Mick et al., 2014).

Hearing Status and Loneliness:

Chen (1994) found an adverse effect on emotional loneliness only in women while Pronk et al. (2011) found an adverse effect on emotional loneliness only in men.

Research Question 4: (Intervention) What are the protective properties of amplification and/or cochlear implants on social isolation and/or loneliness (if any?)

Hearing Status and Social Isolation:

Mick et al. (2014) found that there was no significant effect modification by history of hearing aid use in the association between hearing loss and social isolation. The authors also found that race, income, or educational levels were also not significant effect modifiers.

Hearing Status and Loneliness:

Half of the studies found no effect on loneliness as a result of HA or CI use and the other half showed a reduction in feelings of loneliness as a result of HA or CI use. There was no impact of hearing aid use on scores in the functioning and role limitation in the emotional problems domains as a result of hearing impairment found in the study by Chia et al. (2007). In a quasi-experimental design study, Tesch-Römer (1997) also found no change in social engagement following hearing aid use. Specifically, she found no effect of hearing aid use in domains like social activities, satisfaction with social relations, well-being, and cognitive functioning. Mulrow et al. (1990) found no statistically significant changes in social function, as measured by subscales of the SELF Scale (Linn & Linn, 1984), after treatment with hearing aids. The only improvement was found on the depression subscale, but that was a borderline statistically significant result.

In contrast, Poissant et al. (2008) found that CIs decreased loneliness (and perceived depression) in both elderly and younger recipients. More recently, Weinstein, Sirow, & Moser (2016) found that HA use acts as a buffer against the experience of loneliness.

Table 1a. Included studies pertaining to the relationship between objective and/or subjective HL and loneliness, chronological

Study	Purpose	Age	Gender	Hearing Loss	Social Isolation/ Loneliness Assessment(s)	Result(s)
Weinstein & Ventry (1982) (n = 80)	To determine the relationship between social isolation and performance on several audiologic tasks.	≥65yrs; M=74yrs SD=7.3 R=65-88	M=88	PTA (4-frequency): M=41.4 dB HL SD=12.2 13% (0-25 dB HL) 30% (26-40 dB HL) 41% (41-55 dB HL) 16% (56-70 dB HL)	HMS; SI scale and OI scale from the CARE assessment tool	Audiologic variables (i.e., reactions to constrictions in social networks, feelings of loneliness and inferiority, reduced interest in leisure activities, and desire to withdraw from others) were more highly correlated with SI rather than OI; isolates had greater self-reported psychosocial difficulties and more significant HL than did non-isolates.
Christian et al. (1989)	To determine the distribution and relationship of HL and loneliness in the elderly population.	≥65yrs 65-74=30 75-94=33	M=12 F=51	M=1 (serious/severe HL) W=18 (serious/severe HL)	Revised UCLA Loneliness Scale (large print)	Data suggests that elders developing greater HI as they age will exhibit higher loneliness scores. Of subjects in the 75-94 year group, 39% had loneliness scores in the upper third as compared with 27% of subjects in the 65-74 year group.
Chen (1994) (n = 88)	To explore the relationship between hearing handicap and loneliness, and hearing handicap and self-esteem.	≥65yrs; M=74.9 yrs SD=n/a R=65-90	M=45 (65-86yrs); W=43 (65-90yrs)	Perceived HL	UCLA Loneliness Scale (Russell, 1987); Rosenberg Global Self-Esteem (Rosenberg, 1965)	Data analysis revealed that hearing handicap has a significant correlation with loneliness and low self-esteem. Findings are consistent with previous research by Limburg (1988) and Hilhome Herbest (1980) and imply that the higher the elder's level of hearing handicap, the greater the loneliness experienced. Hearing handicap tends to lead to low self-esteem. The higher the loneliness level, the lower the self-esteem. An adverse effect on emotional loneliness was observed only in women.

Poissant et al. (2008) (n = 9)	To compare speech understanding ability, the level of depression, and the degree of loneliness experienced by elderly CI users, adult CI users, and elderly HA users	≥70yrs (9) ≤60yrs (8)		three groups: (1) unilateral CI users ≥70yrs, (2) unilateral CI users ≤60yrs, and (3) bilateral HA users ≥70yrs	UCLA Loneliness Questionnaire; Depression Screening Scale	Cochlear implantation decreased perceived depression in elderly recipients and loneliness in both elderly and younger recipients; elderly CI users were no more depressed or loneliness than their age-matched peers with mild-to-moderate HL who use HAs.
Pronk et al. (2011) (n = 996 & 830)	To determine the possible longitudinal relationships between hearing status and depression and hearing status and social and emotional loneliness in the older population			three groups: (1) unilateral CI users ≥70yrs, (2) unilateral CI users ≤60yrs, and (3) bilateral HA users ≥70yrs	DG Loneliness Scale (De Jong Gierveld & Kamphuis, 1985)	An adverse effect on emotional loneliness was observed only in men. Poorer self-reported hearing scores predicted deterioration in social support (significant association with worsening emotional and social loneliness in Amsterdam.
Pronk et al. (2013) (n = 996 self-report; 830 SIN test)	To (a) determine the longitudinal relationships between baseline hearing status and 4-year follow up depression and loneliness in an older population and (b) investigate possible differences across subgroups in these relationships	R=63-93yrs; Self-report: M=76yrs SIN test: M=73yrs	Self-report: M=426 (43%); F=570 (57%) SIN test: M=362 (44%); W=468 (56%)	SIN test; and perceived HL	DG Loneliness Scale (De Jong Gierveld & Kamphuis, 1985)	Poorer self-reported hearing status and speech understanding in noise were associated with social and emotional loneliness scores; the relationship was dose related, with more severe-self-reported hearing difficulties associated with greater social/emotional loneliness among a unique specific subgroup

Pronk et al. (2014) (n = 1,178)	To investigate whether the rate of decline in older person's hearing status is associated with rate of decrease in their psychosocial health and to explore moderation by baseline hearing status, health-related factors, and sociodemographic factors	R=57-97yrs	M=752 (47%); W=855 (53%)	SIN testing	DG Loneliness Scale (De Jong Gierveld & Kamphuis, 1985)	Faster decrease in speech-in-noise recognition was significantly associated with more increase in loneliness for persons with a moderate baseline SIN recognition (emotional and social loneliness) and for persons who recently lost their partner (emotional loneliness); no relationship was found with depression; results indicate that faster hearing decline results in more increase in loneliness in specific subgroups of older persons: in persons with already impaired hearing and in widow(er)s.
Sung et al. (2015) (n = 145)	To determine factors associated with loneliness in older adults presenting for HL treatment	R=50-94yrs		Pure-tone audiometry (PTA); 82% received HA; 25% received CI	Self-administered questionnaires; UCLA Loneliness Scale; SF-36	Younger age and greater HL were significantly associated with greater loneliness; further studies needed to determine whether hearing treatment can reduce loneliness in older adults
Weinstein et al. (2016) (n = 40)	To investigate buffering effects of HA use on perceived social and emotional loneliness	R=62-92yrs; M=80.4; SD=7.2	M=14; W=26	SIN testing	DG Loneliness Scale (De Jong Gierveld & Kamphuis, 1985).	HA use appears to be a buffer against the experience of loneliness

R=range; M=mean/male; SD=standard deviation; W=woman; SIN=speech-in-noise

Table 1b. Included studies pertaining to the relationship between objective and/or subjective HL and social isolation, chronological

Study	Purpose	Age	Gender	Hearing Loss	Social Isolation/ Loneliness Assessment(s)	Result(s)
Mulrow et al. (1990) (n = 188)	To assess whether HAs improve the QoL of elderly persons with HL.	≥71	Not specified	Objective (screened at 40dB HL with HI defined as a better-ear threshold of ≥40 dB or greater at 2000 Hz; and self-report via HHIE	SELF Scale	Social, emotional, and communication difficulties were found to be caused by HL. Acquired HL is associated with social and emotional isolation. HAs were found to be successful treatments for reversing the social, emotional, and communication dysfunctions caused by HI.
Appolonio et al. (1996) (n = 1,192)	To clarify the relationships between the use of sensory aids and the QoL and mortality of elderly people suffering from sensory deprivation.	R=70-75yrs	M=389; F=811	Perceived HL	SF-36 Scale	Results showed that uncorrected sensory impairment was associated with poorer social engagement and poorer mental health.
Resnick et al., (1997) (n = 18,873)	To examine the relationships between three sensory and communication abilities and levels of social engagement and time in activities among institutionalized elderly residents	M=82.1yrs; SD=10.6yrs	M=4,595 (24.3%) F=14,278 (75.7%)	Perceived HL	Minimum Data Set (MDS) 2.0 questionnaire	Results show a strong association between the effects of hearing, visual, and communication impairments and low levels of social engagement and time spent in activities. Severe HI was associated with 42% greater prevalence of low levels of engagement and 30% greater prevalence of little or no time involved in activities. Associations were significant but of lesser magnitude for moderate and severe HL.

Chia et al. (2007) (n = 2,431)	To examine hearing loss on (QoL) metrics that contained measures of social and emotional function	M=67.0yrs; 1,845 ≥ 60yrs; 586 < 60 yrs	M= 43.9%	1347 (55.4%) without measured HL; 324 (13.3%) unilateral - 285-mild, 22-mod, 17-sev; 760 (31.3%) bilateral HI - 478-mild, 207-mod, 75-sev	SF-36 Scale	HL is implicated in the development of social isolation; HI was associated with poorer scores in the functioning and role limitation due to emotional problems domains on the SF-36 scale; effect modification by age and gender was not assessed; regular HA use did not have an impact on scores.
Brink & Stones (2007) (n = 12,254)	To determine if functional hearing impairment in continuing-care residents is associated with mood and social engagement (what remains unresolved is whether effects of HI on activity and mood are direct; mediated through communication; or due to correlated deficiencies (e.g., in cognitive or physical status).	M=80.72yrs SD=7.54 yrs	M=5,121 (42%) W=7,133 (58%)	Perceived HL	MDS 2.0 questionnaire	Results consistent with hypothesized direct effect of functional hearing impairment on mood. Results showed that functional HI had indirect effects on social engagement in 3 of 8 analyses and on mood in 7 of 8 analyses. Path analysis showed that HI impairs linguistic communication and that impaired linguistic communication is related to lower levels of mood and social engagement. Placed previously discovered associations of HI and linguistic communication, cognition, social engagement and mood in a model suggesting that HI affects mood through the following sequence: (a) HI impairs communication, (b) impaired communication lowers mood, and (c) lower mood results in lower levels of social engagement.

Yamada et al. (2012) (n = 1,254)	To investigate whether self-reported HL in older adults is associated with a decline in their ability to perform instrumental activities of daily living (IADL) or a decline in social participation	R=65-74, and 75+	M=685 (54.7%); W=686 (45.3%)	Perceived HL	Single question to assess self-reported HL; subscales of the Tokyo Metropolitan Institute of Gerontology Index of Competence (TMIG-IC) to measure levels of IADL and social participation	Self-reported HL was associated with a decline in IADL, but not with social participation
Mick et al. (2014) (n = 1,453)	Cross-sectional study with two objectives. One was to determine if ARHL is associated with social isolation and the second was to determine whether factors such as age, gender, income, or hearing aid use moderate the association	60-69yrs (n=860); 70-84yrs (n=593)			SIS (3 items from the NHANES SSQ and marital status)	Greater HL was associated with increased odds of social isolation in women aged 60 to 69 years old. Effect modification by gender was significant in this age group. -HL was not significantly associated with social isolation in other age and gender groups

Mick & Pichora-Fuller (2016) (n =)	To determine if poorer audiometric hearing thresholds are associated with poorer cognition, social isolation, burden of physical or mental health, inactivity due to poor physical or mental health, depression, and overnight hospitalizations among older American adults with unacknowledged or unaddressed HL (1999-2010 NHANES)	R=60-70+		normal or unacknowledged/unaddressed HL; Pure-tone audiometry (air) performed; HL defined as PTA >25 dB HL and reported "a little trouble hearing"	4 items from the NHANES SSQ combined into a dichotomous summary measure of social isolation	Unacknowledged or unaddressed HL was associated with a significantly increased risk of social isolation among 60-69-year olds but not those 70 years or older. -It was also associated with lower cognitive scores on the DSS Test among 60-69-year olds. -Study differs from prior studies by focusing specifically on older adults who have unacknowledged/unaddressed HL because they are likely to benefit from pure-tone hearing screening. -Finding of association b/w HL and measures of social isolation and cognition in these specific samples extends previous findings on unrestricted samples of older adults including those who had already acknowledged hearing problems.
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R=range; M=mean/male; SD=standard deviation; W=women; SIN=speech-in-noise

Table 1c. Included studies pertaining to the relationship between objective and/or subjective HL and both loneliness and social isolation, chronological

Study	Purpose	Age	Gender	Hearing Loss	Social Isolation/ Loneliness Assessment(s)	Result(s)
Tesch-Römer (1997) (N = 140)	To determine if there is any evidence that the provision of HAS leads to positive intervention effects (in 5 psychological domains known to be affected by presbycusis) in their recipients	R=51-75yrs	M=45% W=55%	Aural Rehab Group: PTA (0.5, 1, 2, 4 kHz) = 36.0 dB HL PTA (1, 2, 4 kHz) = 47.3 dB HL HI Control Group: PTA (0.5, 1, 2, 4 kHz) = 25.8 dB HL PTA (1, 2, 4 kHz) = 37.8 dB HL NH Control Group: PTA (0.5, 1, 2, 4 kHz) = 11.6 dB HL PTA (1, 2, 4 kHz) = 16.4 dB HL	Hearing diary (rating of positive/negative affects, social activity durations, reports of hearing problems, and HA satisfaction); study-specific measure asking respondents to rate of 14 leisure social activities; avg daily time spent with others calculated from diaries; UCLA Loneliness Scale	In with mild to moderate hearing loss, HA use has positive effects on self-perceived hearing handicap, but there is no effect of HA use in domains like social activities, satisfaction with social relations, well-being, and cognitive functioning. No change in social engagement.
Kramer et al. (2002) (n = 3,107)	To examine hearing loss on quality of life (QoL) metrics that contained measures of social and emotional function	R=55-85yrs	M=1,506 W=1,601	Perceived HL	DG Loneliness Scale to measure loneliness; size of social network to assess social functioning	HI elderly report significantly more depressive symptoms, lower self-efficacy and master, more feelings of loneliness, and a smaller social network than normally hearing peers. Whereas chronic diseases show significant associations with some outcomes, HI is significantly associated with all psychosocial outcomes.

R=range; M=mean/male; SD=standard deviation; W=women; SIN=speech-in-noise

Table 2. Main instruments used to evaluate the impact of hearing loss or perceived hearing loss on feelings of social isolation, loneliness, and/or social activity constraints/social engagement/social functioning

Social Isolation/Loneliness Instrument	Goal	Items	Study
DG Loneliness Scale (De Jong Gierveld & Kamphuis, 1985; De Jong Gierveld & van Tilburg, 1999)	Contains two subscales, emotional and social loneliness, used to quantify feelings of social and emotional loneliness	11	Kramer et al., 2002; Pronk et al., 2011; 2013; 2014; Weinstein et al., 2016
Subscales of the Tokyo Metropolitan Institute of Gerontology Index of Competence (TMIG-IC)	Measures the competence required for community-residing older adults to live independently in the community. The social participation subscale of the TMIG-IC is measured according to reported engagement in visiting friends, giving advice to family or friends, visiting friends or family in the hospital, and initiating conversations with young people.	Not specified	Yamada et al., 2016
36-Item/12-Item Medical Outcomes Study Short-Form (SF-36/12 Scale; Ware & Sherbourne, 1992)	A generic instrument used to assess a person's HRQoL using a multilevel scale that assesses mental and physical health function.	36	Chia et al., 2007; Sung et al., 2015
UCLA Loneliness Scale (Russell, 1987); German version of UCLA Loneliness Scale (Quast, 1986; Russel, Peplau, & Cutrona, 1980)	Assesses a perception of feeling lonely by measuring a person's satisfaction with social relations. Relatively short, highly reliable, and valid in both assessing loneliness as a unidimensional phenomenon, and in discriminating between loneliness and other constructs (Christian, 1989).	20	Chen, 1994; Christian et al., 1989; Poissant et al., 2008; Sung et al., 2015 Tesch-Römer, 1997;

SIS	Four items from the NHANES SSQ were combined to measure social isolation. Questions were selected from the Yale Health and Aging Study (Seeman & Berkman, 1988) and the Social Network Index developed for use in the Alameda County Study (Berkman & Syme, 1979) (as cited in Mick & Pichora-Fuller, 2016). Three items from the SSQ and marital status were combined into a summary measure of social isolation to form the SIS in the study by Mick and Colleagues (2014).	4	Mick et al., 2014; Mick & Pichora-Fuller, 2016
MDS 2.0 questionnaire	A wide-ranging instrument that measures the health and well-being of institutionalized residents in such areas as mood, behavior, communication ability, disease, and mobility. It contains measures of cognition, functional status, including functional hearing impairment, communication, vision, psychosocial well-being, mood, disease diagnoses, continence (urinary and bowel), skin condition, health conditions, activity level of preferences, medications, and treatments or procedures.”	Not specified	Brink & Stones (2007); Resnick et al. (1997)
SI and IO Scale from the CARE (Gurland, Kuriansky, Sharpe, Simon, Stiller, & Birkett, 1977-78)	The goal of the CARE is to reliably elicit, record, grade and classify information on the psychiatric, medical, nutritional, economic, and social problems of the older person. The items in the CARE assessing social situations and problems included modified versions of the Performance Test of Activities of Daily Living (PADL; Kuriansky & Gurland, 1976) which have been validated by Bennett (1970; as cited in Gurland et al., 1978). Assessment to measure physical disorders, psychiatric disturbances, and social problems; of two social isolation scales, the SI scale assesses respondents’ reaction to constrictions in social networks, feelings of loneliness and inferiority, reduced interest in leisure activities, and desire to withdraw from others. The OI scale quantifies individuals’ number of face-to-face contacts with friends and relatives, distant significant others, and involvement in a variety of leisure activities during the month prior to the interview.	CARE=38; SI=19 OI = 31 SI=24	Weinstein & Ventry (1982)
SELF Scale (Linn & Linn, 1984)	Measures physical, emotional, and social function. Assesses six areas of functioning: physical disability, social satisfaction, symptoms of aging, depression, self-esteem, and personal control.	54	Appollonio et al., 1996; Mulrow et al., 1990

Table 3. Summary of studies investigating an effect of degree of hearing impairment (dose), age, gender, and intervention on social isolation and/or loneliness

Dose Effect		Age Effect		Gender Effect		Intervention Effect	
Social Isolation	Loneliness	Social Isolation	Loneliness	Social Isolation	Loneliness	Social Isolation	Loneliness
Resnick et al., 1997;	Weinstein & Ventry, 1982;	Mick et al., 2014;	Christian et al. (1989);	Mick et al., 2014	Pronk et al., 2011	Chia et al., 2007 (no effect);	Poissant et al., 2008 (effect);
Brink & Stones, 2007	Christian et al., 1989; Chen, 1994; Pronk et al., 2013	Mick & Pichora-Fuller, 2016	Chen, 1994; Sung et al., 2015			Tesch-Römer, 1997 (no effect)	Weinstein et al., 2016 (effect)

DISCUSSION

The purpose of this systematic review is to summarize the literature associated with social isolation, social and emotional loneliness, and self-rated hearing among older adults with hearing loss ranging from mild to severe. Additionally, several questions were posed:

- 1) (Dose Effect) Is there a relationship between the degree of hearing loss and social isolation and/or loneliness?
- 2) (Age Effect) Is there an age effect in the relationship between self-reported hearing loss and social isolation and/or loneliness?
- 3) (Gender Effect) Is there a difference between men and women's perception of social isolation and/or loneliness and does this influence health effects differently?
- 4) (Intervention) What are the protective properties of amplification and/or cochlear implants on social isolation and/or loneliness (if any?)

All included studies demonstrate an association between hearing status and either social isolation or loneliness. Additionally, dose, age, and gender effects were found in some of the studies with the majority of findings in agreement with each other across those variables. Discrepancies were still identified when results pertained to an effect of age and gender on outcomes of social isolation and/or loneliness as well as the effect of HA or CI use on feelings of loneliness.

Of the five studies that measured for a dose effect modifier on an outcome of loneliness, all five were in agreement that the greater the perceived or measured hearing loss, the more lonely the affected individual felt (Weinstein & Ventry, 1982; Christian et al. 1989; Chen, 1994; Pronk et al., 2013). Similar to the results by Weinstein and Ventry (1982), Resnick and colleagues

(1997) that showed that higher levels of functional HI are associated with lower levels of social engagement. The study by Pronk and colleagues (2014) further implicated the rate at which hearing declines in the outcome of loneliness, stating that the faster the rate of decline, the more increase in loneliness can be reported by the individual.

Russel (1982) reported that it is a generally supported idea that loneliness does not necessarily increase with age though there are instances where a sharp increase in loneliness is found after the age of 80 years (as cited in Christian et al., 1989). The current review of literature revealed that when a “younger-older adult” group was compared to an “older-older adult” group, that it was the younger older adult groups that experienced loneliness (Christian et al. 1989; Sung et al. 2015) and social isolation (Mick et al., 2014; Mick & Pichora-Fuller, 2016). Mick et al. (2014) found that among women, only those aged 60 to 69 years experienced greater odds of social isolation as a result of increased hearing loss than did women aged 70 to 84 years. Similarly, a finding of increased risk of social isolation was found among individuals (in both men and women) aged 60-69 years and not among those aged 70 years or older (Mick & Pichora-Fuller, 2016).

A more common finding of “younger older adults” experiencing more social isolation and loneliness than “older-older adults” raises a question about whether the different age groups find themselves in different social environments that may account for this finding. As was noted earlier, one of the changes that adults experience as they approach the age of 65 in America, is the transition toward retirement. It may follow that with a reduction for opportunity for social interaction comes a reduction in the demand necessary for communicating, thereby, lessening the chance of the individual experiencing the negative effects of impaired communication. In one study, for example, van der Werf and colleagues (2010) found that in individuals with HI, there

was a higher chance of developing psychotic experiences when living in more densely populated, or urban, neighborhood. If the younger of the older adults are reporting more social isolation and feelings of loneliness, it is of interest to investigate whether the demands of the social environment play a role.

With respect to gender effects on social isolation or feelings of loneliness, studies identified were not all in agreement. Mick et al. (2014), for example, found that hearing loss was significantly associated in social isolation in only women aged 60- to 69-years and not in men or in other age groups. With regards to feelings of loneliness, Chen (1994) found self-reported hearing loss to have an adverse effect on emotional loneliness only in women while Pronk et al. (2011) found an adverse effect on emotional loneliness only in men. A more common finding of adverse effect of gender on emotional loneliness being observed more in men than in women (as reported by Pronk et al. 2011), however is supported by literature.

Erdman & Demorest (1998a;b) and Garstecki & Erler (1999) reported that men use fewer non-verbal communication strategies and report less problem awareness and more denial than women. As a result, these coping mechanisms may explain the adverse effect on men's emotional loneliness (as cited in Pronk et al., 2011). Another explanation for the effect for men is provided by Dykstra & de Jong Gierveld (2004) who state that men are more likely to find an intimate attachment figure in marriage. Women, on the other hand, can find this intimate attachment and find protection from emotional loneliness in other close ties (as cited in Pronk et al., 2011), so may not feel the effects as strongly than men, when an intimate attachment is absent or communication with that person is compromised (i.e., as a result of a HI).

Mick et al. (2014) also report on differences in how men and women use verbal communication to obtain emotional support. They cite Wood and Inman (1993), for example,

that state that men primarily view dialogue as a way to accomplish instrumental tasks, convey information, and maintain autonomy in relationships. According to Maltz and Borker (1982), dialogue is the primary vehicle by which women create and maintain intimacy and connectedness (as cited in Mick et al. 2014). Burleson (1997) and Burleson et al. (2002; 1985), women were found to rate expressive skills such as ego support, conflict management, and comforting higher than men who gave greater weight to instrumental or interactional skills (as cited in Mick et al. 2014). Additionally, Burleson (1997) and MacGeorge, Clark, & Gillihan (2002) have shown that women are better at providing emotional support than men. This may, therefore, result with hearing impaired men receiving more support from their partners than women, at least in heterosexual relationships (as cited in Mick et al. 2014).

Studies were also not in agreement on the effects of HA or CI use on social isolation or feelings of loneliness. In a quasi-experimental design study, Tesch-Römer (1997) found no change in social engagement following hearing aid use. Specifically, she found no effect of hearing aid use in domains like social activities, satisfaction with social relations, well-being, and cognitive functioning. There was also no impact of hearing aid use on scores in the functioning and role limitation in the emotional problems domains as a result of hearing impairment found in the study by Chia et al. (2007) and no change in social function post-hearing aid use found by Mulrow and colleagues (1990). In contrast, Poissant et al. (2008) and Weinstein and colleagues (2016) found a positive effect of intervention on loneliness. Poissant and colleagues (2008) found that CIs decreased loneliness (and perceived depression) in both elderly and younger recipients. More recently, Weinstein and colleagues (2016) found that HA use acts as a buffer against the experience of loneliness.

Clinical Implications:

The results of this systematic review reveal that there is an association between subjective and/or objecting hearing loss and social isolation and/or loneliness. Abundant literature demonstrates that loneliness is strongly associated with cognitive impairment and poor mental health (Wilson et al., 2007), depressive symptoms (Cacioppo, Hawkley, & Thisted, 2010), and increased systolic blood pressure (Hawkley, Thisted, Masi, & Cacioppo, 2010). Social isolation and loneliness have been associated with reduced physical activity levels (Hawkley, Thisted, & Cacioppo, 2009) and were identified as risk factors for physical and mental health problems, including cardiovascular disease and heightened inflammatory response to stress (Cacioppo et al., 2000; Hawkley & Cacioppo, 2010; Steptoe, Owen, Kunz-Ebrecht, & Brydon, 2004; as cited in Sung et al., 2015). The unmarried and more socially isolated were found to have higher rates of tuberculosis and accidents, respectively (Holmes 1956; Tillman and Hobbs, 1949; as cited in House et al., 1988). Furthermore, psychiatric disorders such as schizophrenia were associated with being unmarried and more socially isolated (Faris, 1934; Kohn & Clausen, 1955; as cited in House et al., 1988). Linzen et al. (2016) demonstrated that people with hearing impairment are at an increased risk of psychosis.

Based on the results of this systematic review and evidence associating loneliness with poor health and mental outcomes, the results underscore the importance of screening for and identifying hearing loss in older adults as a modifiable factor that could reduce loneliness and promote healthy aging in this population.

Research Needs:

Literature examining the difference between social isolation and loneliness suggests that people who report a deficiency in human contact often feel lonely (Yildirim & Kocabiyik, 2010; as cited in Holt-Lunstad et al., 2015) and that social isolation may promote feelings of loneliness (Peplau and Perlman, 1982; as cited in Hawkley et al., 2009). However, Coyle and Dugan (2012) suggested that there is often no significant correlation between social isolation and loneliness, stating that the two may be independent constructs in which one may occur without the other (as cited in Holt-Lunstad et al., 2015).

The results of this review demonstrated that there have been no studies to date, to the author's knowledge, which investigated a relationship between the degree of hearing loss and a psychosocial outcome of social isolation together with loneliness. Additionally, further exploration of the effects of hearing aids, cochlear implants, or other hearing assistive technologies is needed to be performed while accounting for variables such as age, gender, complexity of social environment, and rate of hearing decline. Continued research in this area may help health professionals working with older adults screen for a potential risk factor for social isolation and or loneliness.

The review of literature points to a need for continuing research in the area of psychosocial outcomes, specifically social isolation and social and emotional loneliness in hearing impaired older adults and whether gender or rate of hearing decline has a differential impact on these outcomes. Research is lacking in agreement as to how age, gender, and intervention modifies the association between hearing status and social isolation and loneliness. Investigations that employ more controlled studies, that are prospective as opposed to cross-

sectional, in order to confirm a causal effect of hearing status on social isolation and/or loneliness.

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